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Please find below and/or attached an Office communication concerning this application or proceeding.

SUPPLEMENTAL EXAMINER'S ANSWER
To respond to a reply brief under 37 C.F.R. § 41.41 dated June 18, 2005

The broadest claim in this application is the independent claim 1.

Response to Argument

Appellant on page 2 under Appealed claim 1, second paragraph argues that "Examiner's Answer to appealed claim1 do not address all the words or the entire subject matter".

i.e. determining a first alignment approximation, based on distances between one or more points in the first image and the second image.

Examiner's reply: Gupta et al. in col. 3, lines 44-62 teach clearly the limitations of the Appellant claim language. Gupta et al. disclose in the mentioned col. only the interesting points in the mask image are matched with their corresponding points in the opacified image, at step 58 see fig. 2. In order to match a point in the mask image to its corresponding point in the opacified image, and in one embodiment, a small tile of imagery around the point in the mask image is correlated with all tiles in the opacified image. This process proceeds hierarchically from the lowest resolution to the highest resolution. The center of the tile in the opacified image that gives the maximum correlation is identified as the corresponding match point. Paraphrase: As Appellant on page 3 second paragraph points out that Gupta et al. at col. 4, lines 41-46 clearly states that each pixel in the mask image (equivalent to Appellant's claim limitation "a first image") is transformed by <u>the displacements</u> (i.e. the distance between the two points) of given by interpolation to find the location of the corresponding pixel in the opacified image (equivalent to Appellant's claim limitation "a second image"). Examiner's note: It is crystal clear that Gupta et al. in the abstract disclose distinctly, in match point generation, a set of two-dimensional points

(i.e. can be a function of x and y, well known Cartesian Coordinates) in the mask image and their corresponding points in the opacified image are derived. On top of all that Gupta et al. deal with X-ray images (i.e. mask and opacified images), generating digital subtraction angiography (DSA) is a known X-ray procedure for observing vasculature. See col. 1, lines 10-120 of Gupta et al., in one known DSA imaging method, X-ray images of anatomy are taken before and after an X-ray opaque contrast agent is injected into the blood vessels. The X-ray image taken before injecting the contrast agent is sometimes referred to as the mask image and the X-ray image taken after injecting the contrast agent is sometimes referred to as the opacified image. Logarithmic subtraction of the mask image from the opacified image should remove all but the image data associated with the opacified blood vessels.

Appellant on same paragraph argues that Gupta et al. do not align images to form an initially aligned second image. Paraphrase: Gupta et al. use match point generation to create a transformation process. Examiner's reply: Examiner requested in the Examiner's answer on page 7, lines 4-6 from Appellant to clarify the following terms (alignment, aligning or aligned in the claim 1), but Appellant repeatedly do not provide substantial definitions to the Examiner. Therefore, Examiner's interpretation: terms alignment, aligning or aligned are equivalent to term "match point" i.e. to adapt or suit so that a balanced or harmonious result is achieved, that Gupta et al. referred, *id.*

Appellant on page 3, third paragraph argues that Gupta et al. do not determine a second alignment approximation. Examiner's reply: Contrary, Gupta et al. at col. 2, line 35-40 teach after performing match point generation, locally-adaptive image-to-image warp generation is performed using the image-to-image match points (i.e. similar to a second alignment

approximation). That is, a transformation function is generated that maps the matched points in the mask image to their corresponding points in the opacified image.

Appellant on page 4, second paragraph argues that the second reference Frazier et al. do not suggest a second alignment approximation based upon the distances between points.

Examiner's reply: Frazer et al. at col. 6, lines 41-43 teach the output of the plate location correlation system (i.e. similar to Appellant's claim language of "alignment") is input to a second correlation system (i.e. similar to Appellant's claim language of "second alignment") for plate reading to locate the license plate therein.

Appellant on page 4, last paragraph argues that the reference Gupta et al. do not specify a combination of the first and the second alignment as defined by appealed claim 1.

Examiner's reply: As Examiner pointed out from previous rejection that Gupta et al. do not <u>explicitly</u> specify the language of "a combination of the first and second alignment". Gupta et al. are silent in respect to the claim language that Appellant uses as " a combination …". However, Gupta et al. in the abstract teach for obtaining sub-pixel registration of mask and opacified digital X-ray images includes the steps of match point generation, locally-adaptive image-to-image warp generation, and log subtraction, for <u>generating a DSA image</u>. Examiner assumption: Gupta et al. are generating a (digital subtraction angiography) DSA image (i.e. equivalent to the term that Appellant uses "combination" in claim 1) by combining the opacified and mask images.

Appellant on page 5, second paragraph argues the following statement constitutes a new rejection: Examiner states that the Laplacian is a great tool for an image with pixel intensity values and considers a function U(x, y) where x and y are spatial variables.

Examiner's reply: the second reference Frazier et al. for Edge enhancement and shadow reduction applies a Laplacian operator on the input image. The Laplacian Operator is very well known tool and a person skill in this art should be familiar with the application of the Laplacian Operator. The definition can be found from any mathematical/physics books or e.g. the following link from the Internet: The Examiner copied and pasted the definition for the Laplacian operator for the Appellant.

http://www.answers.com/laplacian+operator?gwp=11&ver=1.0.6.171&method=3

Laplace operator

In mathematics and physics, the Laplace operator or Laplacian, denoted by Δ, is a differential operator, specifically an important case of an elliptic operator (or a hyperbolic operator when defined on pseudo-Riemannian manifolds), with many applications in mathematics and physics. In physics, it is used in modeling of wave propagation and heat flow; it occurs in the Helmholtz equation; it is central in electrostatics and represents the kinetic energy term of the Schrödinger equation. In mathematics, functions with vanishing Laplacian are called harmonic functions; the Laplacian is at the core of Hodge theory and the results of de Rham cohomology.

Definition

The Laplace operator is a second order differential operator, defined as the divergence of the gradient:

$$\Delta = \nabla^2 = \nabla \cdot \nabla$$

In the *n*-dimensional Euclidean space, it is the sum of all the *unmixed* second partial derivatives:

$$\Delta = \sum_{i=1}^{n} \frac{\partial^2}{\partial x_i^2}.$$

Here, it is understood that the x_i are Cartesian coordinates on the space; the equation takes a different form in spherical coordinates and cylindrical coordinates, as shown below.
In the three-dimensional space the Laplacian is commonly written as

$$\Delta = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}.$$

The Laplacian can be generalized to non-Euclidean spaces, where it may be elliptic or hyperbolic. For example, in the Minkowski spacetime the Laplacian becomes the d'Alembert operator or d'Alembertian

$$\Box = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2} - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}$$

This operator is often used to express the Klein-Gordon equation and the four-dimensional wave equation. The sign in front of the fourth term is negative, while it would have been positive in the Euclidean space. The additional factor of c is required because space and time are usually measured in different units; a similar factor would be required if, for example, the x direction was measured in inches, and the y direction was measured in centimeters. Indeed, physicists usually work in units such that c=1 in order to simplify the equation.

In the three-dimensional space, the simplest form of Laplacian is commonly written as Cartesian coordinates on the space, see above equation. In the two-dimensional space the Laplacian is commonly written without a Z coordinate. E.g. a function of x and y or it can be showed as U(x, y). The function "U" is often described in terms of its graph, which consists of all points (x,y) in the plane. The reference and Examiner do not just use the Laplacian operator as a term of art, but also the applications of the Laplacian operator that covers linear and non-linear differential equations. Examiner emphasizes that the two dimensional function U(x.y) is just an example and the Laplacian operator covers the two dimensional coordinates. In mathematics, a quantity whose value is determined by the value of some other quantity, e.g., "The yield of this field is a function of the amount of fertilizer applied" means that a given amount of fertilizer will yield an amount of whatever crop is growing. Examiner strongly disagrees with Appellant's comment, i.e. the function of e.g. U(x, y) constitutes a new rejection. Examiner uses one of the simplest form of U(x.y) to show the application of the Laplacian or differential operator. How does Appellant show the application of the Laplacian or differential operator?

Appellant on page 8 regarding appealed claim 4 argues that Gupta et al. do not teach implementing RANSAC algorithm.

Examiner's reply: The step of RANSAC algorithms is well known in the art, (the structure of the RANSAC algorithm is simple but powerful. Repeatedly, subsets are randomly selected from the

input data and model parameters fitting the sample are computed. The size of the random samples is the smallest sufficient for determining model parameters.). However, Appellant fails to illustrate the calculations, variables and interpretation of data in detail or refer Examiner to the specification where RANSAC is disclosed. However, Gupta et al. in col. 2, lines 31-46 teach similar concept of RANSAC algorithm, by cross-correlating the sample data between images.

Appellant on page 9 regarding Appealed claim 5 argues that the reference Gupta et al. do not teach the limitation in claim 5.

Examiner's reply: As Examiner repeated before, Gupta et al. in cols. 3-4 lines 63-67 and 1-6 teach the image tiles in the mask and the opacified images may be rotated or translated with respect to each other.

Appellant on page 9 regarding appealed claim 6 argues that the references do not teach the limitation in claim 6.

Examiner's reply: the method homographic matrix is well known in the art, and the references are using correlation method (matching techniques). Frazier et al. in the abstract disclose a novel method for reading the license plates involves performing a modified binary correlation of an image of the plate with reference characters to provide output signals indicative of the symbols on the plate.

Appellant on page 10 repeated the same argument as before regarding appealed claim 7.

Examiner's reply: Frazier et al. teach the limitation in col. 5, lines 50-54 that to find plates of more than one style, the process of locating plates can simply be repeated (i.e. equivalent to broad term of "second alignment" in the claim) once for each style, using a different plate template each time. Gupta et al. in col. 3, lines 59-62 teach that process proceeds hierarchically

from the lowest resolution (i.e. equivalent to first alignment) to the highest resolution (i.e. equivalent to second alignment). The center of the tile in the opacified image that gives the maximum correlation is identified as the corresponding match point.

Appellant on page 10 repeated the same argument as before regarding appealed claim 8.

Examiner's reply: Frazier et al. in figs. 4C and 4D illustrate four corners when edges meet and form an angle, the four corners of a rectangle.

Appellant has been repeated similar arguments for claims 9-20.

For the above reasons, the rejections should be sustained.

Respectfully submitted,

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Art Unit 2672

Javid Amini
September 13, 2005

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